4 Assessment of the wholesale market

This chapter provides an assessment of electricity market concentration, market power and liquidity in Ukraine. It also includes a theoretical discussion of the specificities of market power in electricity markets. This is followed by an analysis of regulatory interventions with a significant impact on competition in Ukraine's wholesale market. Finally, the chapter identifies market entry barriers that can limit the emergence of more competition in the long term.

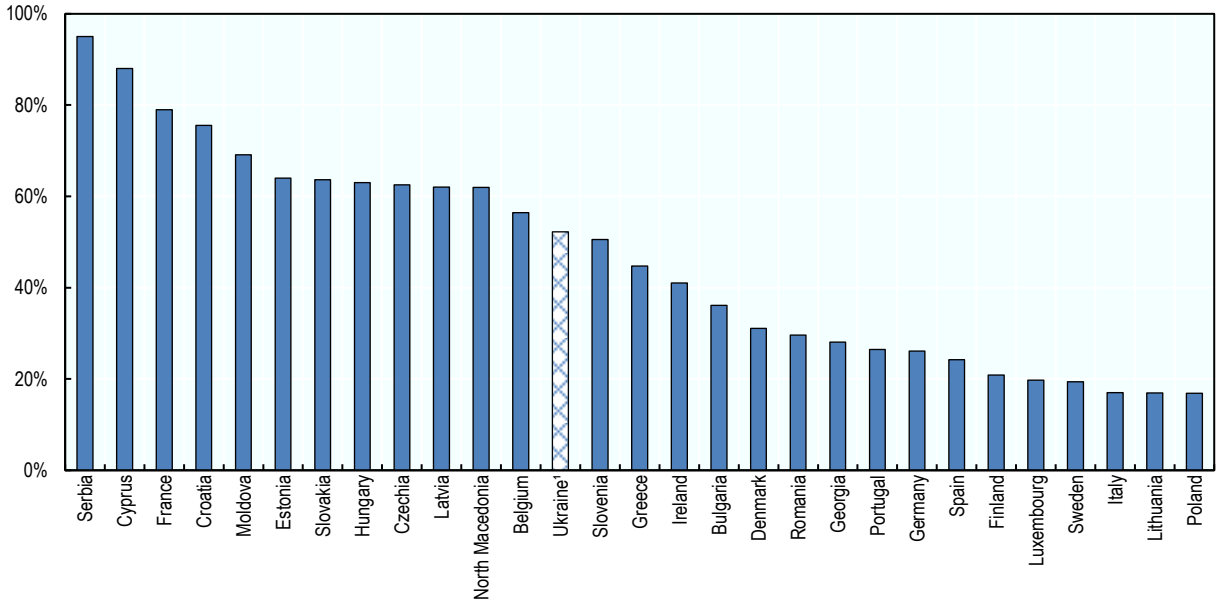
A key element of any competition assessment is the investigation of market structure and market power. Market power refers to the ability of a firm (or group of firms) to raise and maintain prices above the level that would prevail under competition. In newly liberalised electricity markets, the exercise of market power can hinder or even derail the transition towards competitive and efficient wholesale and retail markets.

Traditionally, measures of market concentration such as numbers of firms, market shares and the Herfindahl-Hirschman Index (HHI) have been used as a proxy for the intensity of competition and the assessment of market power. Although they can reveal some useful information about market structure, they do not capture several electricity market-specific aspects of market power.

4.1. Concentration and market segmentation

Due to historical reasons, high capital requirements, economies of scale and regulation, high levels of concentration in generation are a common feature of many electricity markets worldwide. Figure 4.1 shows the share of the largest generator in Ukraine (namely Energoatom) and other European countries. Ukraine with 52%, is within the mid-range. However, many of the countries with higher shares are relatively small and not fully comparable to Ukraine.

Figure 4.1. Market share of the biggest generator by European country, 2021

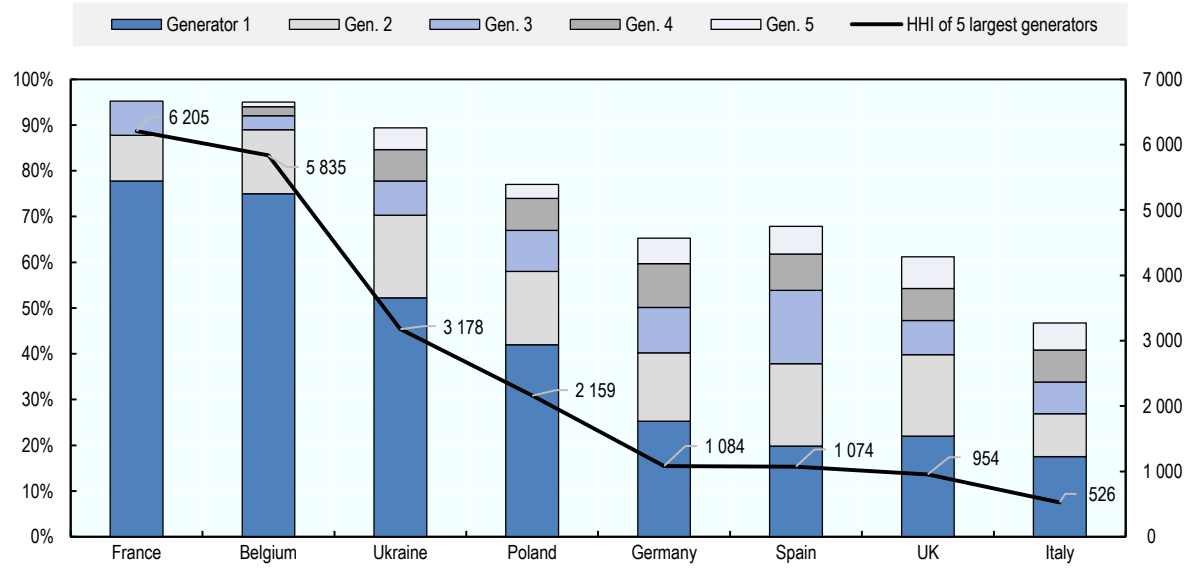


1. 2020 value.
Source: Eurostat (2023[1]), Market share of the largest generator in the electricity market, https://ec.europa.eu/eurostat/databrowser/view/TEN00119/default/table?lang=en&category=nrg.nrg_market; Ukrenergo.

Figure 4.2 compares the shares of the biggest five generators in selected European markets with different characteristics. The French and Belgian generation mixes feature a large share of nuclear, similar to Ukraine. The German and UK electricity markets are Europe's most liquid, while Spain's and Italy's are somewhat isolated due to cross-border constraints. Poland is most similar to Ukraine in terms of population and domestic consumption. For this comparison, the Guaranteed Buyer (GB) is considered a de-facto generator as it markets all renewables under the feed-in tariff (FiT) support scheme. Ukraine's five biggest

power producers dominate generation, with a combined market share of 89%, translating into the third-highest concentration among the selected – mostly larger – European countries.

Figure 4.2. Shares of the five biggest generators, 2021



Sources: Eurostat, Ofgem, URE, ARERA, Bundeskartellamt, CNMS, Ukrenergo.

In addition to the shares of the largest power producers, the figure above also shows the HHI index of market concentration. Even though Poland and Ukraine appear similar in terms of the combined market share of the five biggest producers, with 77% and 89%, respectively, the HHI is one-third lower in Poland, reflecting a higher number and larger combined share of smaller players.

Table 4.1 provides an overview of key attributes of Ukraine‘s biggest electricity generators. It shows that state-ownership is the norm and that suppliers focus on different generation technologies. A significant technology overlap exists only between DTEK and Centerenergo, which both operate fossil fuel power plants.

Table 4.1. Overview of the five largest generators in Ukraine, 2020

Company	Technology portfolio	Ownership	Share of generation
Energoatom	Nuclear, one pumped hydro	State	52%
DTEK	Coal- and gas-fired	Private	18%
Guaranteed Buyer	solar, wind, small hydro, biofuel	State[1]	8%
Centerenergo	Coal- and gas-fired	State	7%
Ukrhydroenergo	Large hydro	State	5%
Total			**90%**

1. The Guaranteed Buyer markets the output of private generators.
Source: Ukrenergo (2021[2]), Production and sale of electric energy by generating companies, http://web.archive.org/web/20211022135312/https://ua.energy/uchasnikam_rinku/administrator-komertsijnogo-obliku/statystychni-dani/vyrobnytstvo-ta-vidpusk-elektrychnoyi-energiyi-generuyuchymy-kompaniyamy/.

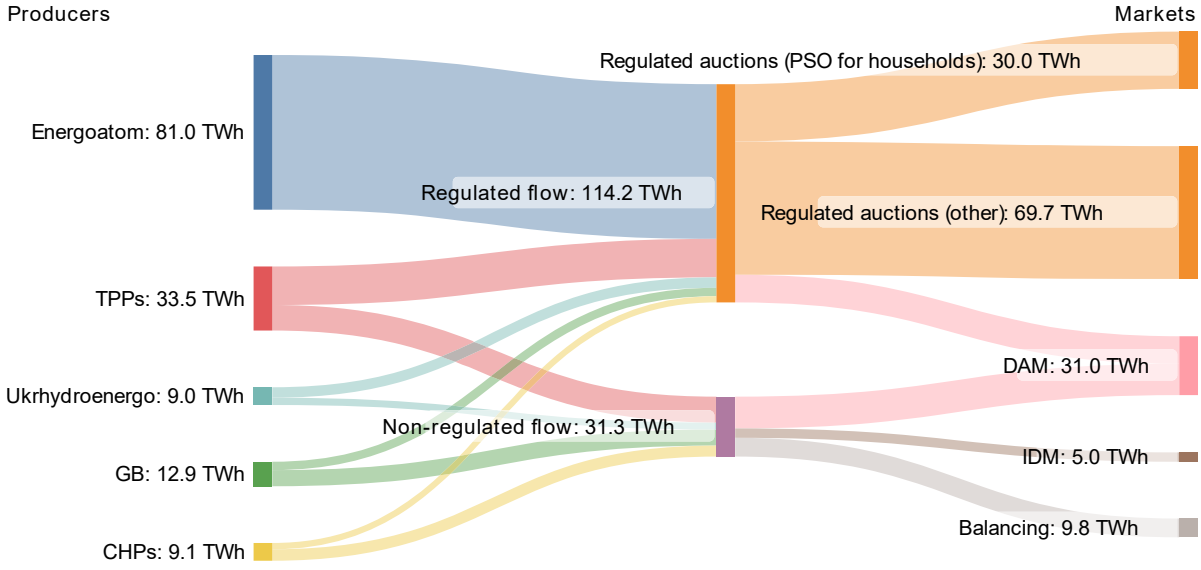
Ukraine's energy regulator has introduced several measures aiming to reduce the risks associated with high levels of market concentration. These include: 1) an obligation for producers to sell a minimum share of output on the day-ahead market; 2) an obligation for producers to sell power bilaterally on the power exchange under the regulated auction rules; and 3) self-supply restrictions for vertically integrated holdings. Additionally, considering the significant share in generation of Energoatom, and its unique position as a state-owned nuclear power producer, the government imposed a fourth measure, a public service obligation (PSO) for households, further limiting Energoatom's freedom to market its output.

These measures redistribute primary volumes of electricity and thereby change the size and the supply-demand structure of all market segments. Most obviously, regulated sales through bilateral auctions (i.e. sales in the special section of the UEEX), reduce the volumes available in other market segments, such as the day-ahead market (DAM).

Figure 4.3 shows the extent and effect of regulatory interventions on electricity volumes. The regulated flow (the vertical orange bar in the middle of the chart) represents volumes directed to specific market segments by regulatory obligations. The unregulated flow (the vertical purple bar) represents volumes unaffected by regulatory obligations.

The obligations limit producers' freedom to sell their output, but they are not equally restrictive and do not necessarily change the behaviour of market participants. For example, the obligation to sell at least 10% on the DAM may very well be in line with what (at least) some producers would do in the absence of such an obligation. Conversely, sales in the special section of the UEEX occur only because they are prescribed; otherwise, this segment would not even exist.

Figure 4.3. Effects of regulatory obligations on primary sales (TWh)



Note: This diagram shows sales by electricity producers, with supplies on the left, and markets where sales takes place are on the right. Intermediate nodes group sales into two categories "regulated" and "non-regulated". The amounts are not representative of total trading volumes across all market segments as only primary sales are shown.
Source: OECD calculations based on Ukrenergo 2021 generation data and current regulations.

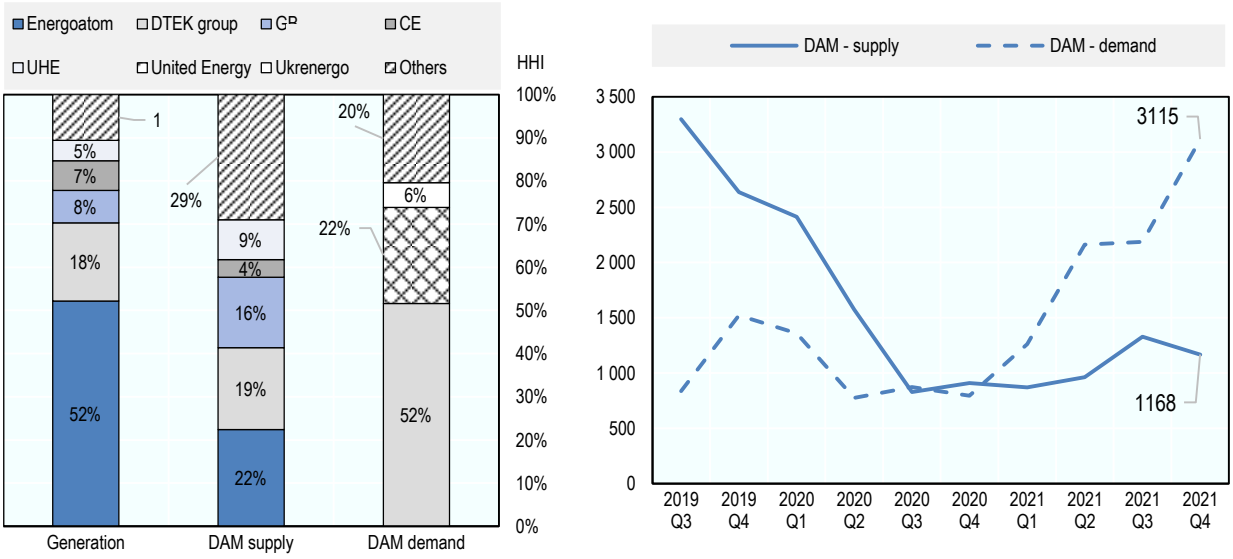
The OECD estimates that the regulated flow includes around 80% of total electricity production in Ukraine. This means that a large majority of electricity produced is sold on a market segment determined by regulation rather than by producers' choice. Most of the regulated flow originates from Energoatom and thermal power plants, but all producers contribute. Only around 20% of total electricity production is sold

on market segments freely chosen by producers. This unregulated flow originates from all types of producers.

By directing specific volumes of electricity to specific market segments, the regulatory obligations partly pre-determine producers' shares of the different market segments.

Figure 4.4 shows how regulatory obligations change suppliers' shares on the DAM. The share of the five largest suppliers on the DAM decreases from 89% to 70% because of regulatory obligations. Energoatom's share declines the most, from 52% to 22%. The shares of the GB and Ukrhydroenergo double, while Centrenergo's drops from 7% to 4%. The supply share of DTEK group is not substantially affected, increasing only slightly from 18% to 19%. The share of other companies rises from 11% to 29%. This includes increased activity by traders that trade electricity on the DAM previously procured in bilateral auctions. Overall, regulatory obligations significantly reduce the shares of large suppliers and supply side concentration on the DAM. This may contribute to reducing market power on the DAM, but whether this is actually the case and to what extent requires an in-depth investigation of DAM bids.

Figure 4.4. DAM supply shares and HHI after regulations



Sources: NEURC 2021 data from operative monitoring, OECD calculations.

The evolution of HHI since market liberalisation shows a strong decrease in supply side concentration and an increase in demand side concentration on the DAM. Two factors explain the increased demand side concentration: first, the growing share of bilateral agreements reduced volumes on the DAM; and second, DTEK's share of demand increased significantly because of self-supply restrictions introduced in November 2021. Previously, part of DTEK's demand was covered through intragroup sales.

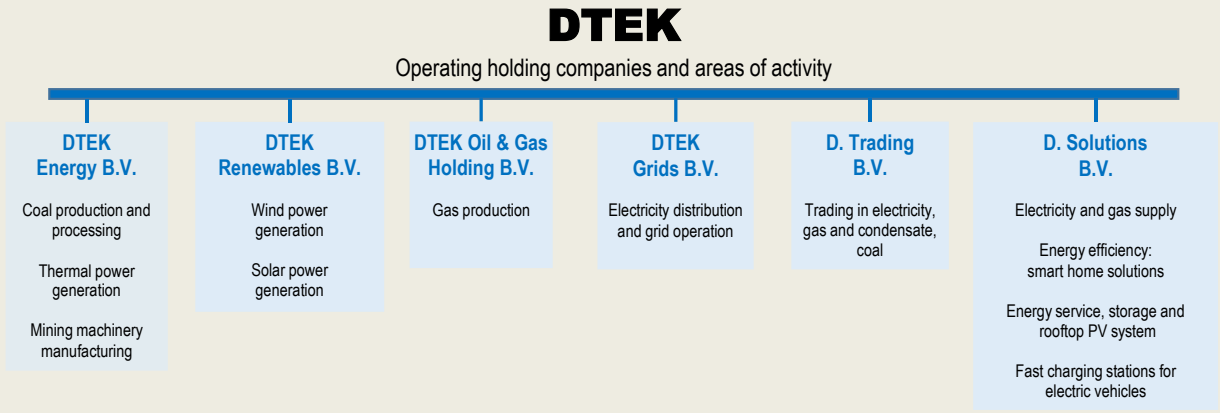
DTEK Group has a unique position on the DAM as it has a significant presence both as a producer (seller) and a retail supplier (buyer). More broadly, DTEK Group has other business activities (see Box 4.1), which make it a very large consumer of electricity.

Box 4.1. DTEK Group

DTEK Group is owned by SCM Holdings Ltd. SCM also owns Metinvest, an international group of steel and mining companies. Metinvest is one of the biggest electricity consumers in Ukraine. SCM is present in all parts of the energy value chain:

- electricity consumption: 8% of total consumption in Ukraine
- energy coal (G-grade): 76% of domestic production, 75% of consumption
- power generation: 20% by a mix of coal- and gas-fired thermal, solar and wind power plants
- electricity distribution: 48% of final consumption delivered by four distribution system operators (DSOs)
- electricity trading: 55% of demand on spot markets
- supply: around 33% of supply to final consumers
- export: de-facto control over 200 MW power line to Poland.

Figure 4.5. Structure of DTEK group



Source: Based on DTEK, https://dtek.com/en/.

4.2. Market power

Factors beyond concentration impact the degree of competition within an industry, including producers' incentives, elasticity of demand, short-run potential for market entry and output expansion (Borenstein et al., 1999[3]). These factors are not captured by concentration measures but are critical for the electricity market because, with some exceptions, electricity cannot be stored, short-term demand is inelastic, and supply and demand must be always in balance. (Borenstein et al., 1999[3]) show that because of these factors, market concentration measures are insufficient to assess market power in wholesale electricity markets and sometimes yield misleading results (i.e. increased price-cost margin when concentration declines) when compared to an oligopoly equilibrium approach.

Specific structural indices are better suited to assessing market power in the electricity sector, such as the pivotal supplier index, the residual supply index and residual demand analysis. Moreover, behavioural

analyses that examine, for instance, bid-cost margins, net revenue benchmarks or physical and economic withholding can be used to find direct evidence of exercises of market power.

In wholesale electricity markets, market power often arises if particular producers play a pivotal role in satisfying demand. If a supplier controls a crucial part of generation capacity, it can gain significant market power and commensurate influence over market prices. Such power can be concentrated in the hands of one producer or spread among a few. The extent to which pivotal suppliers can influence market prices depends on the concentration of their pivotal power and the market-specific merit order curve (Perekhodtsev, Lester and Blumsack, 2022[4]). The merit order curve ranks available generation capacity based on an ascending order of short-run marginal cost. It is used on the DAM to determine which power plants (or units) should be dispatched.

The market power of electricity producers often varies between times of high demand and low demand. Generally, market power is more easily exercised during peak hours, when there is little unused capacity. As more capacity is dispatched, the number of suppliers able to provide additional volumes decreases. In addition, the likelihood that the remaining suppliers with free capacity become pivotal increases.

4.2.1. Exercise of market power

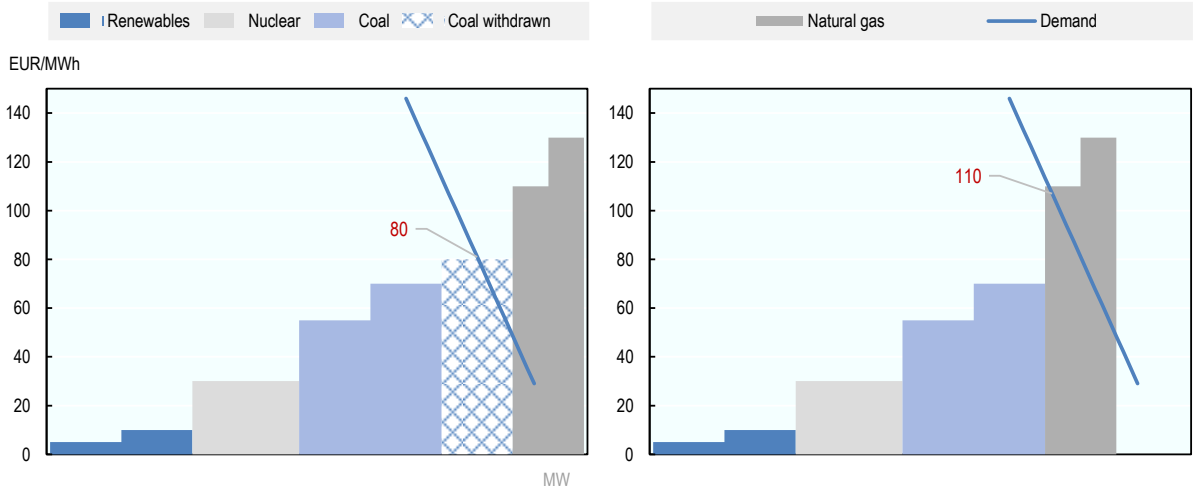
The main way of exercising market power in wholesale electricity markets is through withholding available capacity from the market. This can be done through:

- physical withholding – not offering available capacity to the market that could be profitably produced at the market price
- economic withholding – offering available capacity at a price that does not reflect its marginal cost (including opportunity cost), resulting in non-supply (ACER, 2021[5]).

Both, physical and economic withholding lead to the same result, raising prices above their competitive level and making customers worse off while benefitting producers. In addition, overall welfare is reduced as the consumer loss is larger than the producers' extra profit.

Figure 4.6 shows the effect of physical capacity withholding for a stylised merit order curve. Part of the coal capacity is removed from the merit order curve and as a result the intersection of the merit order curve with the demand curve moves up, meaning the market price increases from 80 to 110 EUR/MWh.

Figure 4.6. The merit order curve and the effect of capacity withdrawal



Source: OECD based on Chauve et al. (2009[6]), The E.ON electricity cases: an antitrust decision with structural remedies, http://ec.europa.eu/

Withholding capacity makes the merit order curve steeper and shifts its intersection with the demand curve, resulting in a higher price. Any supplier pursuing this strategy forgoes the profits from the capacity withdrawn, but the loss can be outweighed by increased profit on its remaining sales due to the higher market price. It is therefore easier for firms with large generation portfolios to profitably withhold capacity.

It is important to note that although the market-clearing price is normally set by the marginal supplier, the supplier exercising market power with a bid that raises the clearing price can be a different supplier. Thus, focusing only on the marginal supplier can result in non-detection of capacity withholding.[1]

Box 4.2. The E.ON antitrust cases

At the end of 2006, in the wake of an electricity sector inquiry, the European Commission opened two cases relating to E.ON's strategies in Germany.

In the first case, the commission investigated E.ON over suspected abuses of dominance in the wholesale electricity market in the form of capacity withholding and deterring investment in electricity generation by third parties.

The commission's analysis established that E.ON may have profitably withheld certain amounts of capacity thanks to the breadth of its generation portfolio. Moreover, third parties might have been deterred from making generation capacity investments by E.ON's offers of shares in its generation projects and long-term contracts.

The second case concerned the balancing market, in which E.ON was suspected of abuses of dominance through its vertically integrated transmission system operator (TSO). E.ON's TSO may have favoured its generation branch over other market participants by purchasing secondary balancing power, provided mainly by E.ON, instead of tertiary balancing power, which was subject to more competition. The commission found that this had likely led to higher balancing costs and significant consumer harm.

Both cases were settled in 2008 with asset divestiture remedies: E.ON had to divest 20% of its German generation portfolio and its high-voltage transmission grid, including its system operation business in Germany.

Source: Chauve et al. (2009[6]), The E.ON electricity cases: an antitrust decision with structural remedies, http://ec.europa.eu/.

4.2.2. Market integrity and transparency

Given the potential for market distorting conduct in electricity markets, both regulation and antitrust enforcement are needed. As underlined by (Moss and Vaheesan, 2014[7]), "this complementarity is essential because (1) regulation can overcome some of the limitations of antitrust law in reaching certain types of withholding, and (2) antitrust is better suited to prosecuting some of the conduct that spawns withholding, and can often obtain more effective remedies".

The design and enforcement of effective regulation is vital. On the one hand, poorly formulated laws and regulations can distort the market, create constraints that hinder competition, and even facilitate concentrations of market power in the hands of specific market participants. On the other, sector regulation, accompanied by competition law enforcement, has a fundamental role to play in addressing market failures and protecting consumers by ensuring competitive, efficient, sustainable markets.

In the EU, the Regulation on Wholesale Energy Market Integrity and Transparency (REMIT)[2] gives regulators the instruments to address market manipulations and abuses of market power. REMIT is without

prejudice to the application of EU competition law but due to some overlaps, certain behaviour can be investigated and sanctioned under either framework.

REMIT came into force in 2011, providing a regulatory framework for the EU's wholesale energy markets and capable of supporting the effective functioning of the market based on open, fair competition. REMIT explicitly prohibits market abuses, defined to include market manipulation, attempted market manipulation and insider trading. In relation to market manipulation, Article 2(2) defines four categories of practices: 1) false/misleading transactions; 2) price positioning; 3) transactions involving fictitious devices/deception; and 4) dissemination of false and misleading information.

REMIT also sets out rules promoting integrity and transparency in the trading of wholesale energy products. It requires market participants to disclose inside information in an effective and timely manner.

Finally, REMIT incorporates two other key principles: monitoring and co-operation. It establishes a sector-specific, comprehensive monitoring framework for wholesale energy markets, implemented in close co-operation and co-ordination between the European Union Agency for the Co-operation of Energy Regulators (ACER), in charge of EU-wide monitoring, and national regulatory authorities (NRAs), in charge of national monitoring, investigations and enforcement.[3]

According to ACER, 109 potential REMIT breach cases were opened in 2021, either notified to ACER by external entities such as NRAs or identified by ACER through its own monitoring (ACER, 2021[8]). Most of the cases related to violations of REMIT's Article 3, concerning the prohibition of insider trading, and Article 5, concerning the prohibition of market manipulation.[4] Box 4.3 illustrates a recent enforcement decision following a breach of Article 5.

Box 4.3. The Energi Danmark/Optimax Energy case

In May 2021, the German Federal Network Agency (Bundesnetzagentur) imposed fines of EUR 200 000 on Energi Danmark A/S and EUR 175 000 on Optimax Energy GmbH for manipulation of the wholesale electricity market. The penalties were the results of investigations opened in September 2020 after significant imbalances were observed in the system in June 2019.

The Bundesnetzagentur's analysis of trading activities indicated market manipulation involving sales of electricity that was not available. The companies placed offers to sell electricity on the intraday market shortly before the electricity was due to be supplied, without intending to supply it. They had an incentive to do so due to the difference between the unusually high intraday price and the lower expected imbalance price on the balancing market. The practice distorted market signals at a time when TSOs had to make full use of balancing energy and take other measures to ensure the stability of the German system. The practice not only allowed the companies to realise unjustified profits but also threatened system stability.

Source : Bundesnetzagentur (2021[9]), Fines for manipulation of wholesale energy market, https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/EN/2021/20211005_BussgeldMarktmanipulation.html.

4.2.3. Market power in Ukraine

In Ukraine, the most crucial wholesale market in terms of price formation is the DAM. Therefore, market power on the DAM has the most potential to distort wholesale market prices.

As previously mentioned, static indicators such as market shares and the HHI do not capture the presence of market power that may arise at specific times. In the electricity sector, market power may shift over a short period of time. The ability to influence electricity prices on the DAM depends on hourly

supply-demand conditions, which can vary significantly within a single day. For instance, certain producers may not be able to influence prices during off-peak hours but may be able to do so during times of peak demand. The non-availability of certain power plants or their individual units due to regular maintenance or technical problems may also affect generators' market power. Overall, HHI values are of limited value for assessing market power on the DAM.

Eventually, the presence and distribution of market power largely depends on the specific structure of the generation fleet and its ownership. In Ukraine, all main generating companies hold technology-specific portfolios. Energoatom, Ukrhydroenergo and the GB hold portfolios with a low marginal cost of production. The GB and Ukrhydroenergo's marginal cost is close to zero, so they never set the price on the DAM. The marginal cost of Energoatom's nuclear power plants is estimated by the NEURC to be 600-750 UAH/MWh, below the day-ahead price most of the time, meaning that Energoatom is rarely in a position to set the price. Additionally, nuclear plants in Ukraine are designed as baseload facilities, maximising their utilisation rate rather than adjusting their output according to the level of demand. This means that Energoatom is normally not competing with thermal and hydro generation to supply peak demand.

Aware of the limitations of static indicators, NEURC has adopted a pivotal supplier test in its monitoring reports, based on two indices, the Pivotal Supplier Index (PSI) and the Residual Supply Index (RSI). The PSI is a binary variable that indicates whether a supplier is pivotal in the market, given hourly supply and demand. In other words, it identifies whether supply can meet demand without the supplier, showing the indispensability of a supplier, which is one form of market power. The RSI has been developed as an extension of the PSI and has been adopted in many countries as a standard method in the monitoring of electricity markets. It provides additional information on the ratio of residual supply relative to demand by revealing the extent to which competitors of a given generator can meet demand using their generation capacities.

NEURC reports the RSI and PSI for Ukraine's two biggest suppliers, Energoatom and DTEK Group, in its quarterly monitoring reports. It uses two approaches for its calculation: one based on total volumes and another excluding volumes regulated by the PSO. The latest available calculation shows the following results for the Integrated Power System (IPS) trade zone during the third quarter of 2021:

- Based on total volumes
  - Energoatom had market power according to both the RSI and the PSI
  - DTEK group had no market power according to both indices.
- Based on volumes excluding the PSO
  - Energoatom had no market power according to both indices
  - DTEK Group had market power in 47.7% of hours, according to the RSI, and no market power according to the PSI.

For the Burshtyn Energy Island trade zone, the RSI indicates that DTEK Group had market power, while according to the PSI, it had market power only in 28.4% of the hours during the third quarter of 2021.

The RSI and PSI show that the PSO significantly reduces Energoatom's market power. In absence of the PSO or under a fully financial PSO, Energoatom would have significant market power, according to these indices. This may not be surprising, given Energoatom's share of generation, but it is unusual for a baseload operator to be able to influence prices in a significant number of hours.

Contrary to NEURC's above conclusions, (Supponen, 2021[10]) states that "DTEK's dominant position in the power market is obvious and well-known". He finds that prices on the DAM are set mostly by thermal generation and that 61% of price-setting capacity is owned by DTEK Group.

From a legal perspective, Article 12 of the Law of Ukraine on the protection of economic competition[5] stipulates the following: "2. The position of a business entity whose share in the product market exceeds

35% is considered monopolistic (dominant), unless it proves that it is subject to significant competition. 3. The position of a business entity can also be recognised as monopolistic (dominant) if its share in the product market is 35% or less, but it is not subject to significant competition, in particular due to the relatively small size of market shares belonging to competitors."

Thus, there is a rebuttable presumption of dominance above a market share of 35%, meaning the obligation to prove the absence of dominance rests with the business entity. Below this threshold, findings of dominance are possible, but the obligation to prove it rests with the Antimonopoly Committee of Ukraine (AMCU).

Compared to the EU, where the European Court of Justice established a presumption of dominance above a market share of 50%[6] and the European Commission considers that "dominance is not likely if the undertaking's market share is below 40%",[7] the threshold in Ukraine is relatively low. However, as pointed out by the AMCU, the national legislation of several EU member states sets a market share threshold of 40% and in Austria it is 30% (AMCU, 2023[11]).

In the context of electricity markets, the most important issue is not so much the presumption threshold but the recognition that market shares do not necessarily correspond with market power. Especially on the DAM, market power depends mostly on the generators' position on the merit order curve rather than on their market share. Marginal generators can influence prices and thus exercise market power even with a relatively low market share, while non-marginal generators are price takers and have limited or no ability to influence prices even if their market share is significant, i.e. above the 35% threshold.

Based on generators' positions on the merit order curve, perhaps the most likely candidate to hold market power is DTEK as it controls most marginal coal-fired plants. Even though its share of electricity generation is well below 35% and the PSI and RSI calculated by NEURC are ambiguous regarding its market power, close monitoring of its behaviour would be warranted, both by the energy regulator and the competition authority.

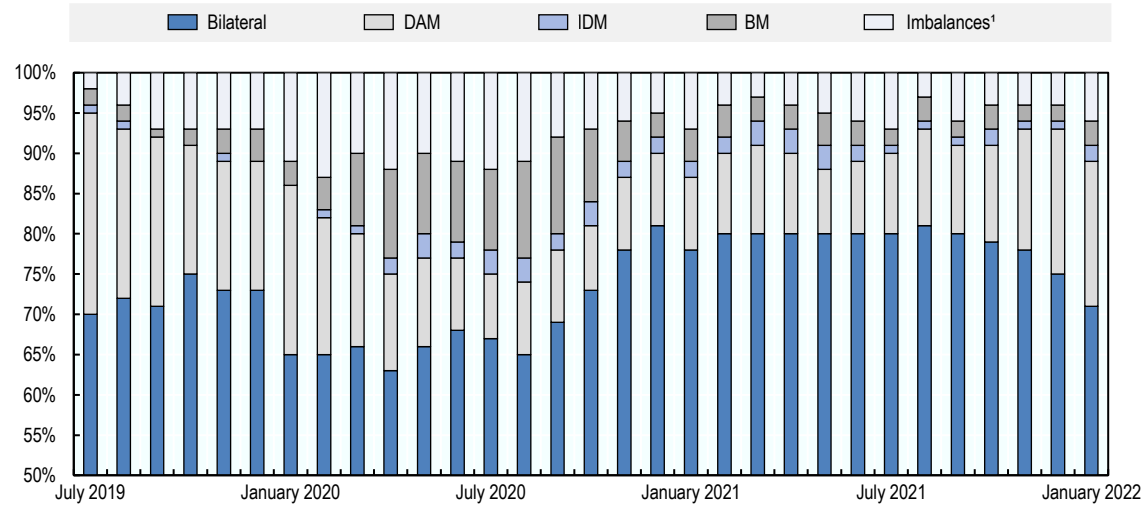
4.3. Liquidity

Liquidity is an important feature of a well-functioning electricity market. Liquid wholesale markets allow market participants to buy and sell electricity in a timely way at reliable market prices. The more liquid markets are, the easier it is for non-vertically integrated firms to compete with vertically integrated firms and for new entrants to compete with incumbent firms. Weak competition and the presence of market power increase uncertainty about short-term and forward prices, and tend to reduce liquidity in all timeframes.

Liquidity in the wholesale market is affected by regulations that either directly control flows of electricity to particular market segments or influence prices through price caps for the DAM, the Intraday Market (IDM) and the Balancing Market.

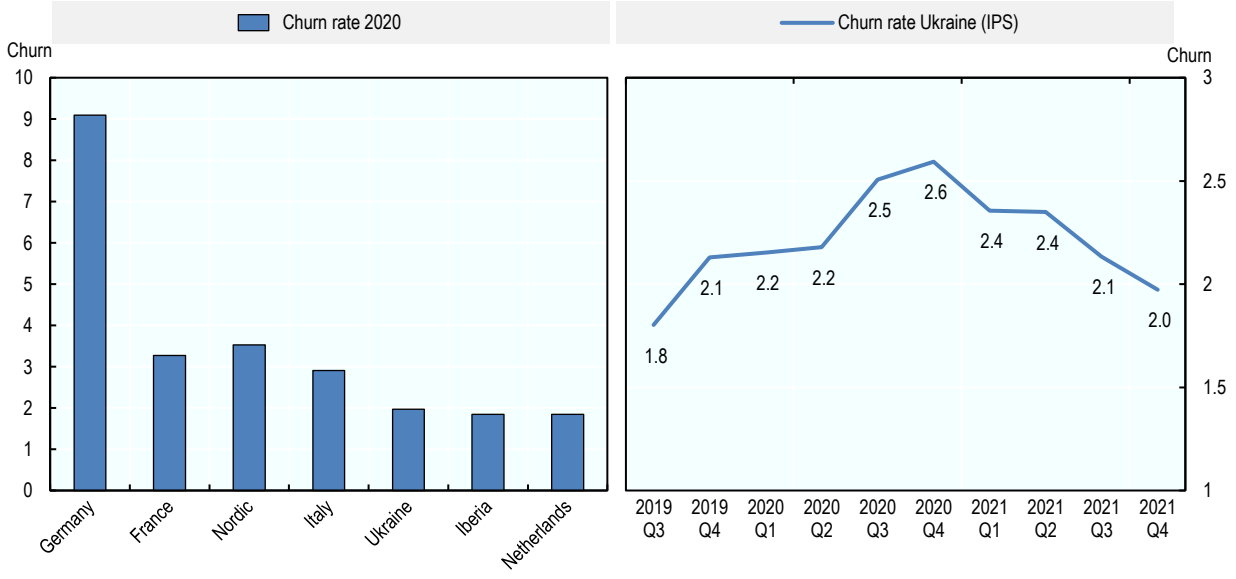
As shown in Figure 4.7, the distribution of trade volumes in Ukraine's wholesale electricity market leans heavily towards bilateral trading. The proportion of volume traded on organised spot markets (the DAM and IDM) has been generally modest and was particularly low from April 2020 to August 2021. The share of spot trading increased after price caps were raised in August 2021 and self-supply restrictions for vertically integrated holdings were introduced in December 2021. This demonstrates the influence of regulatory measures on the distribution of trade volumes and market liquidity.

Figure 4.7. Distribution of trading across segments in Ukraine's electricity market, July 2019-January 2022



1. Imbalances represent the electricity settled after gate closure of the BM. This volume is not traded.
Source: NEURC (2022[12]), Share of trade in different market segments, https://public.tableau.com/app/profile/neurc/viz/2__16324695298060/sheet0_1.

Figure 4.8. Total churn rate in selected European electricity markets



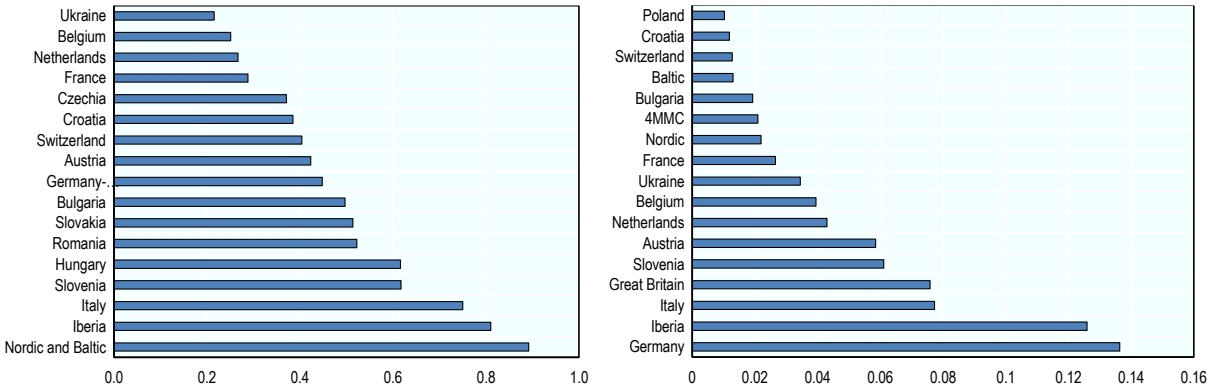
Sources: NEURC (2022[13]), Churn rate in the IPS trade zone of Ukraine, https://public.tableau.com/app/profile/neurc/viz/1__16324693131810/1_; ACER/CEER (2021[14]), Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2020, https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202020%20%E2%80%93%20Electricity%20Wholesale%20Market%20Volume.pdf.

One widely used indicator to assess market liquidity is the churn rate. It is calculated as the ratio of the overall volume traded to total physical consumption. There is no consensus on a level of churn that indicates sufficient market liquidity, but a churn rate of three is considered the minimum value (ACER/CEER, 2021[15]). Ukraine's average churn rate of two (see Figure 4.8) means that electricity

"changes hands" twice before reaching end consumers. The churn rate decreased throughout 2021, indicating a lower level of trading activity.

Considering the DAM specifically, Ukraine has a relatively low churn rate compared to other European countries, despite its regulatory obligation for the sale of a certain share of generation on the DAM. The intraday churn rate in Ukraine is more in line with the average in other countries (see Figure 4.9). This is likely because the price cap on the IDM is above the DAM cap, encouraging generators to shift volume from the DAM to the IDM.

Figure 4.9. Churn rates on the day-ahead and intraday markets



Sources: Market Operator (2023[16]), DAM/IDM Analysis, https://www.oree.com.ua/index.php/web_monitoring_dtorg_year/index_year_dam; ACER/CEER (2021[14]), Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2020, https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER%20Market%20Monitoring%20Report%202020%20%E2%80%93%20Electricity%20Wholesale%20Market%20Volume.pdf.

4.4. Regulatory intervention affecting competition

Competition in wholesale electricity markets is often strongly affected by regulatory interventions. They can safeguard, induce but also hinder competition. They may seek directly to ensure the competitive functioning of electricity markets or, as is often the case, serve other public policy objectives.

In Ukraine, the most important regulatory interventions affecting competition are wholesale price caps and the PSOs for households and renewables. Price caps aim to prevent abuses of market power in the form of excessive prices. The PSOs serve public policy objectives and do not aim to improve competition.

4.4.1. Wholesale price caps

Wholesale price limits were introduced at the initial stage of market liberalisation as a temporary measure to safeguard against potential price increases and spikes. Although they are still treated as temporary, they have become a permanent feature of Ukraine's electricity market.

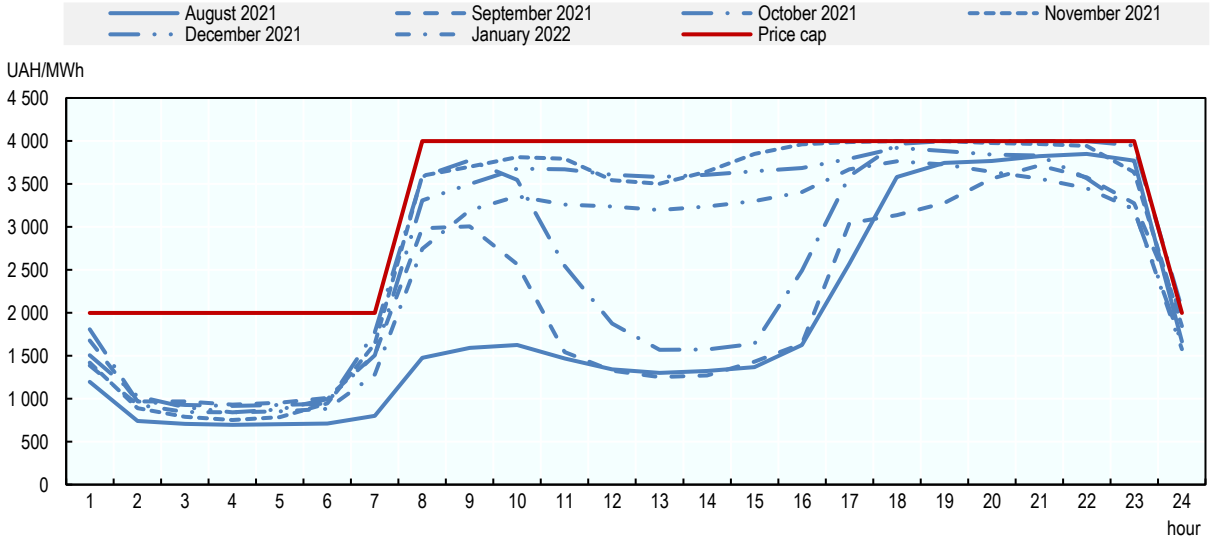
There are minimum and maximum price limits, but the minimum limits have had no significant impact on price formation. The maximum limits, or caps, however, have materially limited price formation in the wholesale market.

Frequent changes in the caps illustrate the difficulty of reconciling them with the efficient functioning of the market.

Price distortions

Figure 4.10 shows the DAM price caps and average hourly prices for the IPS trade zone. In October and November 2021, average prices reached the price cap between 6 p.m. and 10 p.m., suggesting that price formation was affected by the price cap during this period. In the other months depicted and during other hours, the cap was not reached.

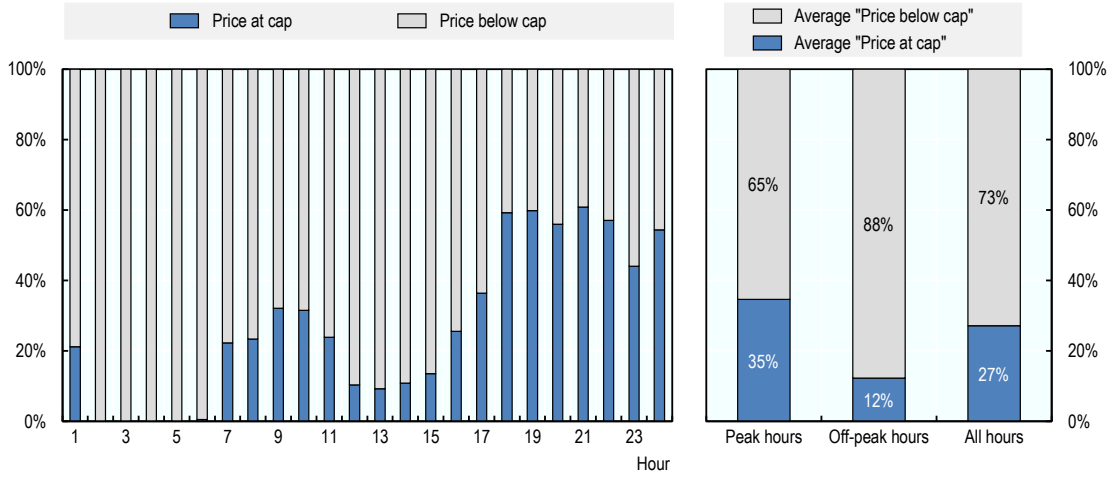
Figure 4.10. Price cap and monthly average prices on the DAM (IPS trade zone), August 2021-January 2022



Source: Market Operator (n.d.[17]), Hourly electricity purchase and sale prices on DAM, https://www.oree.com.ua/index.php/pricectr.

By looking at actual prices, rather than the average, the effect of price caps becomes more visible. Figure 4.11 shows the distribution of hourly prices between August 2021 and January 2022, covering the period after the latest change in price caps until Russia's large-scale invasion in 2022. Prices "at cap" mean they deviated by no more than 1% from the cap. The data shows that prices reached, or almost reached, the cap during 35% of peak hours, 12% of off-peak hours and during 27% of all hours. Between 6 p.m. and 10 p.m., more than half of prices reached the cap, suggesting strongly that price formation was affected during a significant number of hours, at least during the period shown.

Figure 4.11. DAM prices affected by the cap, August 2021-January 2022



Note: "Price at cap" is when the actual price is maximum 1% below the price cap.
Source: Market Operator (n.d.[17]), Hourly electricity purchase and sale prices on DAM, https://www.oree.com.ua/index.php/pricectr.

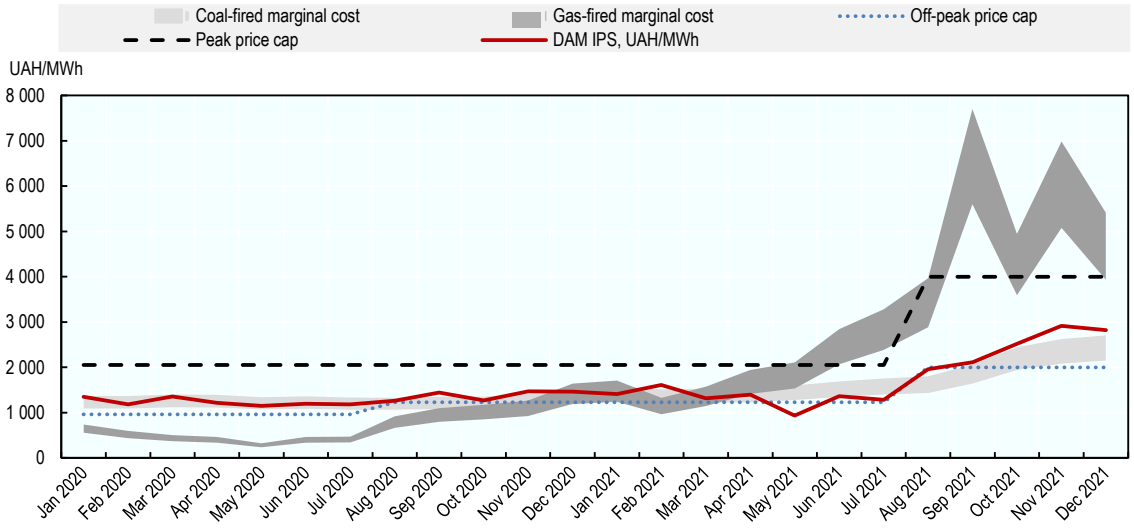
Overall, it appears that price caps prevent market-based price formation and affect prices to a significant extent, especially during peak hours. By preventing price peaks, they reduce incentives for demand response by large electricity consumers and to a lesser extent by residential consumers. Further, they hinder the emergence of new business models relying on prices reflective of supply-demand conditions, such as arbitrage using energy storage technologies, fast-start peak generation and aggregators. By allowing free price formation, both competition and the flexibility of the power system would improve.

Cost recovery and hidden costs

The methodology behind the calculation of Ukraine's price caps has never been officially disclosed, but it appears that they are based on the costs incurred by coal-fired power plants.

Figure 4.12 shows DAM price caps and the estimated marginal costs of coal and natural gas power plants. In 2020, the peak cap (the cap for hours of maximum load) was well above the marginal costs of coal-fired plants, while the off-peak cap (the cap for hours of minimum load) was somewhat below. To the extent that peak demand is met by coal-fired power plants, price caps set in such way should not substantially alter price formation. However, Ukraine's peak demand is met not only by coal-fired plants but also natural gas-fired plants. This was not relevant for price caps as long as natural gas prices were relatively low and the marginal costs of gas-fired plants were below those of coal-fired plants. But that changed towards the end of 2020, when the marginal costs of natural gas plants rose above those of coal-fired plants.

Figure 4.12. Comparison of price caps and estimated marginal costs, 2020-21



Note: Assumes procurement by coal-fired plant operators of 75% domestic and 25% imported coal.
Source: IEA, UEEX, NEURC, Ministry of Energy.

Following the increase in natural gas prices, international coal prices started to rise from the second half of 2020. At the end of July 2021, NEURC increased the off-peak price cap by 28%, but this did not fully offset natural gas price increases. As a result, the marginal costs of gas-fired power plants rose above the peak price cap around May 2021. This made the operation of natural gas-fired plants uneconomical, limited the ability of dual-fuel power plants to switch to natural gas, and gas-only combined heat and power (CHP) plants were unable to recover their costs.

To address this, NEURC issued a temporary order for the purchase of ancillary services, specifically the provision of replacement reserves, at the end of 2021.[8] This was introduced for gas-fired CHP plants and thermal power plants in case they were required to meet the balancing needs of the system or if there were coal shortages. The measure was financed via the TSO's dispatch tariff collected from network users (generators and DSOs). It provided additional income for certain producers and alleviated some of the financial problems they faced. However, it also created an additional source of market distortion by concealing the real price of electricity, and was discriminatory as it was available only to certain producers.

Any potential entrant would receive false signals on which type of generation was required or how it would be priced. With increasingly variable power generation, accurate price signals are critical to encourage market participants to adapt generation or consumption in close to real time, and to promote investments in flexible units of all types, including demand response and energy storage.

Focal points for tacit collusion

Price caps may affect the bidding behaviour of market participants in ways more subtle than simply preventing bids above the cap. A price cap can become a focal point for bidding and may lead to higher prices than the absence of caps. The risk can be highest when sellers expect the "true" market price to be somewhat below the cap. In such cases, it may be tempting to adjust bids upward and bid at or just below the cap. If several sellers engage in this strategy, they can push the price above its competitive level. In other words, the presence of a price cap price can facilitate tacit collusion as it offers a reference point for co-ordinated behaviour. In practical terms, price caps reduce the large number of electricity prices at which sellers may attempt to tacitly collude to one or two well-known prices, namely the peak and off-peak price

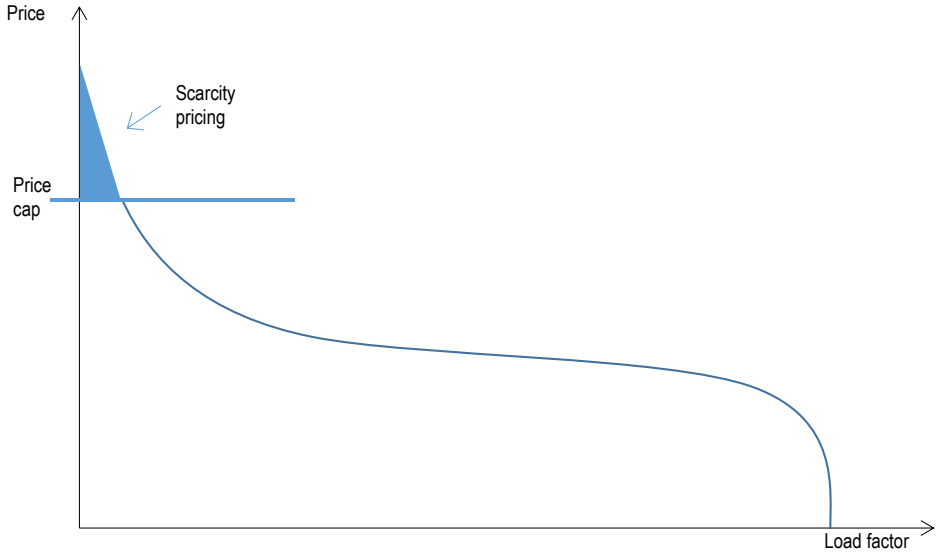
caps. In the Ukrainian context, some producers may also consider it justified to bid above their marginal costs because they may believe that price caps unfairly limit their revenues.

No scarcity pricing and the "missing money" problem

In competitive electricity markets, most producers bid at the level of their short-term marginal costs – the costs related to generating each additional MWh. The capital costs of inframarginal producers are recovered during hours when prices are set by higher marginal cost producers. The capital costs of marginal producers are recovered during hours when scarcity prices occur. Scarcity pricing occurs when market prices rise above the marginal cost of the marginal unit, under conditions in which the system lacks generation capacity to meet high demand. Scarcity pricing is necessary to generate profits to cover the capital costs of marginal producers.

Scarcity pricing is a natural occurrence in the market, as short-term price spikes reflect the mismatch between supply and demand during certain hours. By avoiding price spikes through price caps, a "missing money problem" may occur in electricity markets. This refers to unrealised revenue from high prices that is needed to cover the long-term marginal costs of some generators (see Figure 4.13). This revenue is crucial to incentivise optimal levels of investment. If high prices and corresponding revenues during times of scarcity cannot be collected, generators may be tempted to bid above their short-term marginal costs, resulting in higher average electricity prices.

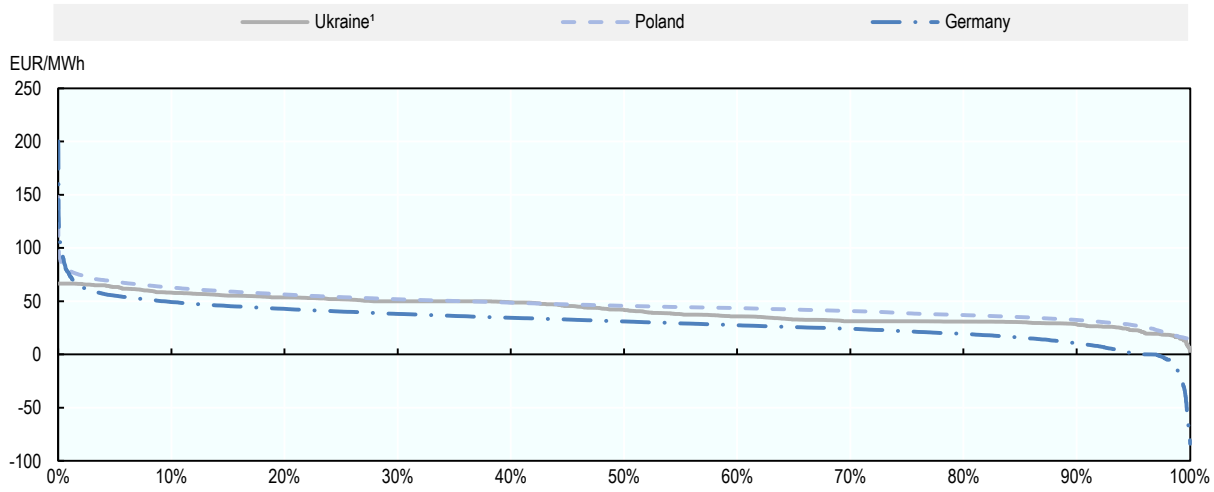
Figure 4.13. Illustration of the "missing money" problem



Source: OECD based on Grigorjeva (2015[18]), Capacity mechanisms in the Eu: Nationalizing energy security?, https://www.researchgate.net/publication/304668651_CAPACITY_MECHANISMS_IN_THE_EU_NATIONALIZING_ENERGY_SECURITY.

In Ukraine, price caps do not allow scarcity prices. Figure 4.14 shows the overall distribution of day-ahead prices in Ukraine, Poland and Germany in 2020.

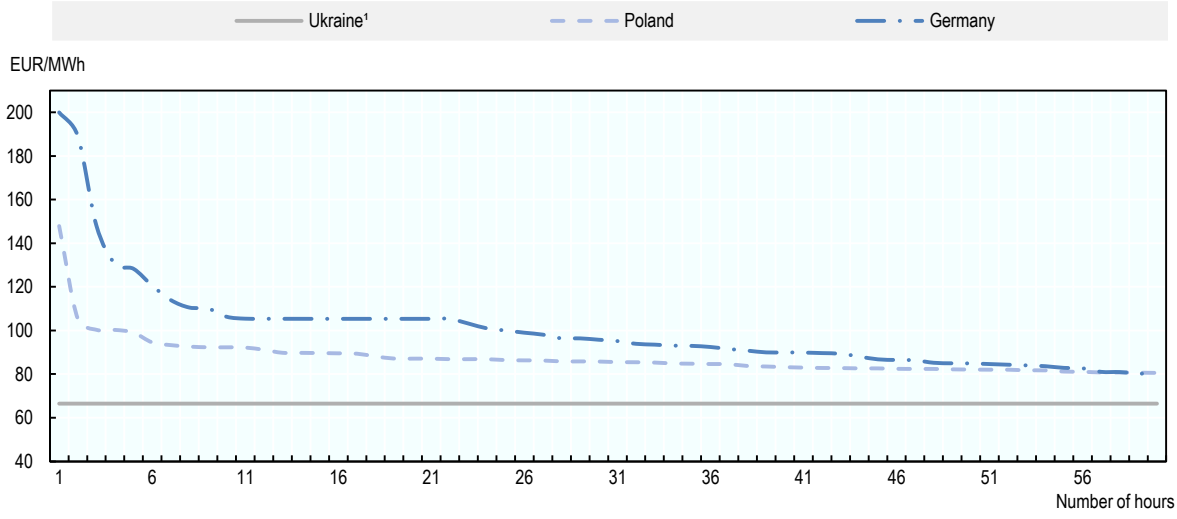
Figure 4.14. DAM price duration curves, 2020



1. IPS trade zone.
Source: ENTSO-E (n.d.[19]), Day-ahead Prices, https://transparency.entsoe.eu/; Market Operator, (n.d.[17]), Hourly electricity purchase and sale prices on DAM, https://www.oree.com.ua/index.php/pricectr.

When disregarding the highest and lowest 10%, prices in Ukraine and Poland were approximately within a range of EUR/MWh 60-30, and in Germany of EUR/MWh 50-10. However, when looking at top and bottom prices, the prices differ widely. Figure 4.15 shows the price duration for the most expensive 60 hours. Prices in Ukraine reach their maximum at 67 EUR/MWh, 1.6 times above the average. In Poland and Germany, prices not constrained by caps rose to 3.2 and 6.7 times higher than the annual average price.

Figure 4.15. Snapshot of price duration curves, 2020



1. IPS trade zone.
Source: ENTSO-E (n.d.[19]), Day-ahead Prices, https://transparency.entsoe.eu/; Market Operator (n.d.[17]), Hourly electricity purchase and sale prices on DAM, https://www.oree.com.ua/index.php/pricectr.

It is noteworthy that despite very high prices in some hours, the average price in Germany was lower than in Ukraine. This is partly due to some very low, negative prices.

The absence of scarcity pricing means accurate price signals are not sent to the market, which may hinder new entries as investors are unable to rely on scarcity events to generate additional profits. Also, without the ability to recover capital costs during scarcity hours, generators may be tempted to incorporate capital costs into their bids, potentially pushing average prices higher.

Limitation on cross-border commercial electricity flows

Price caps also affect cross-border electricity trading. In a free market, electricity is exported or imported depending on price differentials across interconnected countries, with electricity flowing from a country with low prices to one with higher prices. If electricity prices in neighbouring countries are market-based, cross-border trade increases total welfare and both exporting and importing countries benefit. However, when prices in one country do not reflect supply and demand, this is not necessarily true.

In Ukraine's case, price caps create distorted export opportunities and increase the profits of companies exporting electricity. At the same time, price caps can prevent or reduce imports, indirectly increasing the price of electricity in Ukraine and possibly undermining the security of supply.

European price limitation practices

EU Regulation 2019/943[9] on the internal market for electricity states that administrative and implicit price caps should be removed to allow scarcity pricing in the wholesale market. It does, however, allow for the application of technical bidding limits for the day-ahead, intraday and balancing markets. These should not "unnecessarily restrict trade and shall be harmonised for the internal market and shall take into account the maximum value of lost load". To this effect, it requires the implementation of a transparent mechanism to adjust automatically the technical bidding limits in the event they are expected to be reached.

The value of lost load (VoLL) is an indicator of the costs associated with an interruption of electricity supply, in other words, it is the average value consumers place on continued electricity supply.

ACER set the following harmonised minimum and maximum technical bidding limits:

- [-500, +4 000] EUR/MWh for single day-ahead coupling[10]
- [-9 999, 9 999] EUR/MWh for single intraday coupling[11]
- [-15 000, 15 000] EUR/MWh as transitional limits until July 2026, for balancing energy and cross-zonal capacity (based on average maximum VoLL among EU member states).[12]

The limits for the day-ahead and intraday markets are not explicitly based on VoLL but the automatic adjustment mechanism ensures that they do not restrict free price formation.

In contrast to Ukrainian practice, EU price caps are not intended to prevent suppliers from bidding at prices well above the average level. The risk of significant deviations from marginal costs and abuses of market power is addressed by monitoring and regulatory action under REMIT and by competition law enforcement.

4.4.2. Public service obligations

Ukraine's PSO for households affect both the wholesale and retail markets. The PSO for renewables affects the wholesale market but has implications for the finances of several key market participants.

PSO for households

As explained in Section 3.3.1, the PSO for households envisages direct sales of electricity by Energoatom to universal service suppliers (USSs) at average DAM prices, and to the DSOs at regulated prices below

the market price. Based on 2021 market volumes, this amounts to around 4 GW baseload capacity withdrawn from the competitive wholesale market and is equivalent to around 20% of all electricity injected into the grid, or 37% of Energoatom's net output.[13] At the same time, demand is reduced by the same amount. From the merit order perspective, the reduction of supply with low marginal costs and the equivalent reduction of demand should not significantly affect day-ahead prices. The main negative effect is a reduction in overall market liquidity.

Regulated access to the output of a company with unique access to resources exists not only in Ukraine but also in other countries, as in France's *Accès régulé à l'énergie nucléaire historique* (AREHN) or Regulated Access to Incumbent Nuclear Electricity, scheme (see Box 4.4). Such regulations aim to share the benefits of historical investments with consumers and reduce cost advantages over potential competitors.

Box 4.4. Regulated access to nuclear power in France

ARENH is a mechanism in France that allows electricity customers to benefit from historical investments that they have partly financed while at the same time allowing liberalisation of the electricity market by transferring the cost advantage of incumbents to other suppliers and new market entrants.

Under ARENH, the prices and volumes of regulated products were set administratively. Market-dominant generator EDF was obliged annually to sell up to 100 TWh of its nuclear production, around 25% of its average production, on demand to its competitors at a regulated price. The access price was set at a level ensuring fair compensation for EDF by a joint act of the ministers for economy and energy, proposed by the energy regulatory authority. Only suppliers serving final customers in France are entitled to benefit from the ARENH mechanism, with volumes proportional to their domestic customer base, and network operators for covering network losses. The measures must be limited in time (ARENH was set up for 15 years until 31 December 2025) and are subject to regulatory monitoring and review. The measures were notified and cleared by the European Commission as a PSO and comply with EU state aid rules.

It should be noted that the French competition authority has been critical of the ARENH mechanism and is of the opinion that it has not achieved the initial objectives set by legislators.

Source: Ambec and Crampe (2019[20]), Regulated Access to Incumbent Nuclear Electricity, https://fsr.eui.eu/regulated-access-to-incumbent-nuclear-electricity/.

The latest form of Ukraine's PSO for households combines supplies of baseload energy with financial contributions. This design has several drawbacks:

- Regulated prices for households do not cover the full cost of the electricity supplied (i.e. the sum of the cost of production, network tariffs and suppliers' margin).
- All household consumers benefit from the subsidy, independent of their income levels. Vulnerable consumers are not defined in the legislation. This increases the cost of the scheme.
- Artificially low prices for households reduce incentives for energy efficiency. They also reduce incentives to invest in small-scale renewables for self-consumption.
- Artificially low prices send distorted signals on choices between energy sources, i.e. whether to use electricity for heating or natural gas. This reduces the long-term elasticity of electricity demand.
- Artificially low prices for households reduce the scope for competition in the retail market.
- The PSO for households reduces liquidity in the wholesale market as around 20% of electricity volume is withdrawn from competitive trading.

- It creates financial liquidity problems for USSs as they must finance the difference between the prices at which they procure electricity and sell it to households. Eventually, Energoatom pays the difference (through the GB), but that can take several months.
- The PSO for households hides the total cost of regulated prices from taxpayers and citizens.
- The PSO for households is exposed and vulnerable to changes in market conditions. Household electricity prices are fixed while the cost of the mechanism is not. The cost varies with changes in wholesale electricity prices, TSO and DSO tariffs. For example, the cost of the mechanism increases when average market prices rise. Further, even when the cost is stable, the relative financial burden of the mechanism, borne by Energoatom and Ukrhydroenergo, can change. Whenever Energoatom or Ukrhydroenergo's production declines, they must use a larger share of their output and revenues for the mechanism.
- The PSO for households reduces Energoatom and Ukrhydroenergo's profitability and their ability to invest.

PSO for renewables

The design of the PSO for renewables requires renewable energy sources (RES) producers with the "green" tariff to sell their output to the GB, increasing concentration in the wholesale market. Further, RES producers cannot offer balancing services on a competitive basis. Instead, they are curtailed by the TSO when required, de-facto providing downward balancing services.

Since August 2022, RES producers can temporarily opt out of the renewable support scheme and the GB's balancing group and trade directly in the market. By the end of August 2022, a few dozen companies – mostly mid-sized solar producers – among almost 1 000 had decided to do so (Energy reform, 2022[21])

A switch to direct marketing by a significant number of RES producers would benefit competition by encouraging more diverse bidding strategies. Direct marketing for RES producers would also create stronger incentives to reduce forecasting errors and thereby lower the cost of balancing.

4.4.3. Rules for the bilateral agreement market

The bilateral agreement market (BAM) is Ukraine's biggest electricity market by sales volume. Most bilateral trading takes place on the auction platforms of the UEEX. Nevertheless, the BAM does not offer sufficient liquidity or depth, due to three main factors.

First, auctions at the UEEX are separated into a special section and a commercial section, the former being even further segmented. The separation between the sections and segments is legally imposed. Participation in the special segment is limited by legislation. De facto, the different parts of the UEEX are separate marketplaces. The only market-based part is the commercial section, where less than 20% of bilateral contracts are concluded by volume, meaning that the space for actual competition on the BAM is much reduced.

Second, the UEEX suffers from low level of standardisation. There are standard sales schedules (base, peak and off-peak) but many contract terms (such as payment terms, guarantee fees, additional conditions and delivery terms) are set by initiators of auctions. On the one hand, this flexibility is a welcome feature of bilateral contracts. On the other, it can be used to restrict equal access to electricity and negatively affect competition.

Third, regulatory uncertainties may discourage market participants from concluding longer-term bilateral contracts. In particular, market participants may be wary of changes to price caps. As a result, bilateral contracts tend to have a duration of one month or less in the commercial section. This makes the long-term procurement of electricity very risky.

In 2022, the UEEX introduced a platform with standardised products and a more trading-friendly design. It had not been used at the time of writing.

4.5. Barriers to entry

Ease of market entry is an important aspect of competition, limiting the ability of incumbents to sustain prices above competitive levels for significant periods of time. Even potential entry can deter the exercise of market power by incumbents because high profits resulting from high prices rather than efficiency often bring new participants into the market, reducing profit margins. Barriers to market entry are therefore a major competition concern over the long term. Many markets feature at least some barriers that make entry difficult.

Barriers to entry can be structural, legal or regulatory, or a combination of these. Structural barriers consist of absolute cost advantages, substantial economies of scale, capacity constraints, high sunk costs, and circumstances in which the provision of an output requires an input that cannot be technically or economically duplicated. Legal or regulatory barriers result from legislative, administrative or other measures that have a direct effect on the conditions of entry and/or the positioning of participants in the relevant market, including price controls or other price-related measures.

Competition in the electricity sector crucially depends on the distribution of generation assets such as power plants. Barriers to creating new generation capacity can be a major impediment to competition.

In Ukraine, investment opportunities in new generation capacity are limited by several factors. Certain fuels, such as water and coal, and access to nuclear technology are unlikely to be available to new entrants. Loans for coal-fired power plants are mostly unavailable from international banks. Price caps limit the profitability of generation assets, new and old alike. Before Russia's large-scale invasion in February 2022, there was also nominal overcapacity in the system that reduced incentives for new investment.

4.5.1. Non-replicable access to resources and limits to potential generation investment

Newly built power plants must be able to compete with incumbents' marginal costs. If some incumbents have a cost advantage that cannot be matched, it is unlikely that new entrants will constitute a source of competitive pressure.

Two of Ukraine's biggest players, Energoatom and Ukrhydroenergo, operate assets that competitors cannot duplicate due to a lack of access to specific resources: water flow from major rivers and nuclear technology. Most of the potential for large hydroelectric plants in Ukraine has been exhausted, and nuclear energy has very high barriers to entry.

Peak demand for thermal generation is met by coal-fired power plants. Domestic coal extraction is shared between DTEK Group and state-owned mines. Domestic coal is sold to incumbent coal-fired power plants at a lower price than imports. This means that any new investor in coal-fired generation will probably have to use more expensive imported coal, putting it at a competitive disadvantage.

Many international financial institutions have committed to ceasing investment in carbon-intensive projects, and every major development finance institution in the G20 has committed to ramping up support for green energy. It is therefore unlikely that new coal- and oil-fired plants can be financed in Ukraine, reinforcing the position of incumbent coal-fired generators in the market.

These barriers limit the range of technologies potentially available for investment in Ukraine, so new entry in the electricity market is likely to be limited to investments in renewables (excluding large hydro), modern storage technologies and gas-fired engines or turbines. Moreover, investments in gas-fired generation are

currently constrained by price caps that do not always allow the recovery of marginal costs (as discussed in Section 4.4.1).

Capital-intensive investments in renewables have relied on the green tariff support mechanism. This support scheme has proved to be very costly, and has led to late payment and non-payment of the promised green tariffs to RES producers. This has undermined investor confidence in Ukraine's renewables support mechanism and perhaps even in its electricity sector overall.

4.5.2. Nominal overcapacity in the power system

Growing demand for electricity offers greater opportunities for market entry as potential investors and incumbents compete on more equal terms to create new generation capacity. If demand is stagnant, new entrants find it hard to compete with incumbents – even more so if incumbents have spare capacity.

Overall installed dispatchable capacity in Ukraine before Russia's large-scale invasion was around 44 GW, while maximum demand in 2021 was 25 GWh. Before the invasion, Ukrenergo estimated annual demand growth of 1.5% for the next decade. Based on pre-war demand, this translates into 29-30 GW of peak demand in 2031 that would be sufficient to cover domestic demand, even if all export capacity were also used.

Since market liberalisation, no new capacity has been installed in Ukraine, except for renewables under support schemes and new pumped hydro plants built by incumbent suppliers. In fact, a significant amount of capacity is to be decommissioned. As member of the Energy Community, Ukraine is obliged to ensure that all large combustion plants meet EU requirements[14] on emissions limitations. In 2017, the Cabinet of Ministers of Ukraine (CMU) adopted the National Emission Reduction Plan[15] (NERP), setting out Ukraine's intention to significantly reduce emissions from existing large combustion plants. It identifies coal and gas-fired power to be successively decommissioned from 2018 until the end of 2033. Decommissioning has not proceeded according to the original schedule and in 2019 implementation of the NERP was postponed by two to five years. The Ministry of Energy proposed another postponement in 2020 (SaveDnipro, 2021[22]).

The government's policy has been to keep old power plants running for as long as possible while supporting investment in renewables. Amid overcapacity and lacking clear signals on the phase-out of old power plants, there has been no strong business case for new entries.

Discussions have taken place for years on the need for additional flexibility in Ukraine's power system (Natha, 2020[23]). In 2019, the CMU adopted a procedure for the construction of new generating capacity and demand management systems.[16] According to this, Ukrenergo can initiate a tender for the construction of balancing capacities with state support. Such tenders were announced several times, but they never took place. In principle, flexible capacity can and should be provided by the market and state support should be limited to special cases. Before implementing support through capacity mechanisms, efforts should be made to make market-based investments more attractive, in particular by removing price caps in the balancing market. Regarding the impact of flexible capacity on competition, it should be noted that such plants work relatively few hours and do not produce a significant amount of electricity annually. Such capacity would probably be offered in the balancing market and ancillary services, and not affect competition in the bilateral or spot markets.

Due to the war's dramatic impact on both generation capacity and demand, post-war, it will be necessary to reassess the need for additional capacity and the type of such capacity. To enable private investments, accurate supply and demand projections will be needed. Further, the role of state support for any new capacity needs to be decided and communicated.

4.5.3. Debt accumulation

The accumulation of significant debt in parts of Ukraine's electricity sector is a warning sign to potential investors. Without solving the underlying problems in a credible and sustainable way, attracting new investors will be challenging.

The financial and legal problems with the RES support scheme have been much publicised and are well known beyond the circle of existing RES producers. The large drop in electricity demand since February 2022 has also revealed a new financial threat to the RES support scheme. In theory, as total consumption decreases, the relative cost (i.e. cost per MWh) of the RES support scheme increases because the total cost is spread over lower total MWh consumed. In practice, huge damage to, and destruction of, solar and wind facilities has led to lower RES production, thus this problem has not materialised, even if for unfortunate reasons.

Non-payment problems in the balancing market are less widely known but pose a risk to wholesale market participants. Most non-payment can be attributed to customers of the supplier of last resort, namely Water of Donbass – a water supplier in the occupied territory of the same name – and state-owned coal mines. Coal companies cannot pay their electricity bills but, for environmental reasons,[17] legislation protects them from being disconnected from electricity supplies. The cost of supplying these companies ends up as an ever-increasing debt in the balancing market. According to Ukrenergo, that net debt had reached UAH 6.4 billion as of October 2022. (UAH 17.5 billion from market participants to Ukrenergo, UAH 11.1 billion of Ukrenergo debt to balancing service providers.) This creates problems for timely settlement with balancing service providers. Additionally, it makes it very difficult to increase or remove balancing market price caps. If caps were increased, the debt would increase even further and could undermine the financial stability of several market participants, including Ukrenergo, which performs several vital functions in the power sector. Without addressing the question of how to finance the debt source sustainably, a decision on abolishing price caps may be postponed indefinitely.

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Notes

[1] For more details see for example (Pham, 2019[24]).

[2] Regulation (EU) No 1227/2011 of the European Parliament and of the Council on wholesale energy market integrity and transparency, 25 October 2011, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011R1227.

[3] For more details on the application of REMIT see (ACER, 2021[5]).

[4] Full list of enforcement decisions: https://www.acer.europa.eu/remit/co-ordination-on-cases/enforcement-decisions

[5] Law of Ukraine No. 2 210-III "On the protection of economic competition", 11 January 2001, https://zakon.rada.gov.ua/laws/show/2210-14#Text

[6] European Court of Justice's judgment in case C-62/86, AKZO [1991] ECR I-3359, para. 60, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A61986CJ0062.

[7] Communication from the Commission 2009/C 45/02, Guidance on the commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings, 24 February 2009, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52009XC0224%2801%29.

[8] NEURC Decision No. 2003 “On the approval of temporary orders for the purchase of auxiliary services to ensure regulation of frequency and active power in the United Energy System of Ukraine, namely the provision of replacement reserves (tertiary regulation)”, 8 November 2021, https://zakon.rada.gov.ua/rada/show/v2003874-21#Text

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[13] Calculations are based on PSO auction results and 2021 energy balance figures from Ukrenergo.

[14] Directive 2001/80/EC of the European Parliament and of the Council on the limitation of emissions of certain pollutants into the air from large combustion plants, 23 October 2001, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32001L0080.

[15] CMU Order No. 796 “On the National Plan for reducing emissions from large combustion plants”, 8 November 2017, https://zakon.rada.gov.ua/laws/show/796-2017-percentageD1%80#Text.

[16] CMU Resolution No. 677 “On approval of the Procedure for holding a tender for the construction of generating capacity and implementation of demand management measures”, 10 July 2019, https://zakon.rada.gov.ua/laws/show/677-2019-percentageD0%BF#n8.

[17] Retired coal mines must run water pumps to keep them from flooding and contaminating groundwater.